CLAIMS

1. A method for designing a sigma-delta-modulator comprising a plurality of cascaded integrators and a comparator, the method comprising the steps of:

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- providing an input signal to an input of the sigma-delta-modulator,

- determining an amplitude of a signal at an output of at least one of the plurality of integrators,

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- adjusting the signal swing of the output signals of those of the integrators being placed closest in the signal path to the input of the sigma-delta-modulator by adjusting characteristics of those integrators in such a way that the signal swing of those integrators being placed closest to

15    the input is significantly smaller than the signal swing of the remaining integrators.

2. A method according to claim 1, wherein the adjusting step is performed by

20 - adjusting the signal swing of the output signal of a first integrator to a first value, and

- adjusting the signal swing of the output signal of a second integrator to a second value, the second value being larger than the first value.

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3. A method according to claim 1, wherein the integrators being placed closest in the signal path to the input of the sigma-delta-modulator are the two integrators being placed immediately after the input.

30 4. A method according to claim 3, wherein the signal swing of the output signal of the two integrators is below 20 percent of the full scale output signal level of the quantizer.

5. A method according to claim 1, wherein the adjusting step is performed by
35 adjusting gain parameters of the integrators, such as adjusting the feedback gain.

6. A sigma-delta-modulator comprising a plurality of cascaded integrators and at least one comparator, the sigma-delta-modulator being designed using a method according to claim 1.

5    7. A method of controlling a sigma-delta-modulator comprising a plurality of cascaded integrators and a comparator, the method comprising the steps of:

-    monitoring the signal swing of an output signal of at least one of the plurality of integrators and determining if the monitored signal swing
10    exceeds a predefined threshold value, and

-    in case the monitored signal swing exceeds the predefined threshold value reducing the output signal with a predefined factor or value so as to bring the monitored signal swing below the predefined threshold
15    value.

8. A method according to claim 7, wherein the predefined threshold value is associated with a maximum stable input amplitude of the sigma-delta-modulator.
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9. A sigma-delta-modulator comprising a plurality of cascaded integrators, at least one comparator, and means for performing a method according to claim 7.

25    10. A sigma-delta-modulator having a maximum signal (S) to noise (N) plus total harmonic distortion (THD) ratio, S/(N+THD), being larger than a prede-termined value, said predetermined value being determined from a maximum stable amplitude value and a noise power value, the maximum stable ampli-tude value and the noise power value being derivable from an obtainable noise
30    transfer function associated with the sigma-delta-modulator.

11. A sigma-delta-modulator according to claim 10, wherein the predeter-mined value is determined using the expression

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$$20 \log_{10} \frac{MSA_{rms}}{Noise_{rms}}$$

wherein $MSA_{rms}$ is a root mean square value of the maximum stable amplitude value, and wherein $Noise_{rms}$ is the root mean square value of the noise power value.

5   12. A sigma-delta-modulator according to claim 10, wherein the sigma-delta-modulator comprises a plurality of integrators and a least one comparator.

13. A sigma-delta-modulator according to claim 12, wherein the plurality of integrators are cascaded.

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14. A microphone module comprising a sigma-delta-modulator according to claim 6.

15. A hearing aid comprising a microphone module according to claim 14.

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16. A cellular phone comprising a microphone module according to claim 14.

17. A head-set comprising a microphone module according to claim 14.

20   18. A mobile unit comprising a sigma-delta-modulator according to claim 6.

19. A mobile unit according to claim 18, wherein the mobile unit is selected from the group consisting of hearing aids, cellular phones, or head-sets.

25   20. A microphone module comprising a sigma-delta-modulator according to claim 10.

21. A hearing aid comprising a microphone module according to claim 20.

30   22. A cellular phone comprising a microphone module according to claim 20.

23. A head-set comprising a microphone module according to claim 20.

24. A mobile unit comprising a sigma-delta-modulator according to claim 10.

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25. A mobile unit according to claim 24, wherein the mobile unit is selected from the group consisting of hearing aids, cellular phones, or head-sets.

26. A sigma-delta-modulator according to claim 6, said sigma-delta-modulator being implemented as a time discrete circuit.

27. A sigma-delta-modulator according to claim 6, said sigma-delta-modulator
5  being implemented as a time continuos circuit.

28. A sigma-delta-modulator according to claim 6, said sigma-delta-modulator being implemented as an analog circuit.

10  29. A sigma-delta-modulator according to claim 6, said sigma-delta-modulator being implemented as a digital circuit.

30. A sigma-delta-modulator according to claim 6, said sigma-delta-modulator being implemented as a software code.
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31. A sigma-delta-modulator according to claim 10, said sigma-delta-modulator being implemented as a time discrete circuit.

32. A sigma-delta-modulator according to claim 10, said sigma-delta-
20  modulator being implemented as a time continuos circuit.

33. A sigma-delta-modulator according to claim10, said sigma-delta-modulator being implemented as an analog circuit.

25  34. A sigma-delta-modulator according to claim 10, said sigma-delta-modulator being implemented as a digital circuit.

35. A sigma-delta-modulator according to claim 10, said sigma-delta-modulator being implemented as a software code.
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